Introduction to Signals and Systems
EEL 3135
Class Periods: TR | Period 1-2 (8:00AM–10:45AM)
Location: NEB 101
Academic Term: Summer 2023

Instructors:
Name: Tan Wong   E-mail: twong@ufl.edu
Office Location: NEB 461   Phone: 352-392-2665
Office Hours: TR 12:00-1:00 PM

Teaching Assistant/Peer Mentor/Supervised Teaching Student:

- Jacob Blair   Contact: jacob.blair@ufl.edu
- William Diaz   Contact: williamdiaz@ufl.edu
- Oliver Philipp   Contact: ophilipp@ufl.edu
- Junjun Huan   Contact: junjun.huan@ufl.edu

Course Description
Continuous-time and discrete-time signal analysis including Fourier series and discrete-time and discrete Fourier transforms; sampling; discrete-time linear system analysis with emphasis on FIR and IIR systems: impulse response, frequency response, and system function; MATLAB-based programming for Signals and Systems.

Course Pre-Requisites / Co-Requisites
Prerequisite: MAC 2313 (C) & (EEL 3834 (C) or COP 3503C (C) or COP 3504C (C) or COP 2274 (C))

Course Objectives
This course aims to provide analytical skills and numerical tools necessary for further study in communications, control, and signal processing. At the conclusion of this course, you should be able to:
- understand basic concepts of discrete-time signals and linear time invariant (LTI) systems
- provide time-domain and frequency-domain descriptions of these signals and systems
- employ Fourier analysis to design and analyze simple LTI systems
- proficiently use MATLAB as a programming and numerical analysis tool
- implement simple discrete-time systems, such as linear filters, in MATLAB
- program MATLAB to numerically perform Fourier analysis of signals and LTI systems.

Relation to Program Outcomes (ABET):

Outcome	Coverage

Outcome 1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics	Students are assessed using:
	- Focused exam questions on
	  o their ability to solve differential equations
	  o using engineering techniques
	  o their ability to work with complex numbers and exponentials.
	- Exam questions target the use of
	  o impulse responses, frequency response, DTFT, and z-transform methods.
	- Using a MATLAB programming, the students are required to
	  o apply filtering concepts to design a piano octave detection system to meet specifications.

Outcome 6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and	Students are assessed using: - A MATLAB assessment where o Students are provided EKG signals (actual data) of a number of patients from a public database. The students are required to break

use engineering judgment to draw conclusions	each EKG signal down into overlapping windows and apply FFT on each window.
	o From the FFT results, the students then generate a time trajectory of the heart rate of a patient.
	o As the EKG signals are noisy and could occasionally be distorted, the students are required to design algorithms that carefully interpret the FFT results to rid out readings that are not physically reasonable.

Required Textbooks and Software
- Textbook Required
  DSP First, 2nd edition
  Authors: James H. McClellan, Ronald W. Schafer, and Mark A. Yoder
  Publisher: Pearson
  ISBN: 0136019250
- Software Required: MATLAB
  - o Available on UFApps (requires using Gatorlink VPN)

Course Schedule

Date			Lecture Videos / In-class Activities	Text Chapters
Tue	May	16	Introduction, Complex number review	1, App. A
Thu	May	18	Sinusoids, Complex Sinusoids, Sums of Sinusoids 1	2
Tue	May	23	Sums of Sinusoids 2, Fourier Series 1	3
Thu	May	25	Fourier Series 2, Sampling Sinusoids 1	3, 4
Tue	May	30	Sampling Sinusoids 2, Interpolation	3, 4
Thu	Jun	1	Discrete-Time Systems, FIR Filters	5
Tue	Jun	6	Convolution, LTI Systems 1	5
Thu	Jun	8	LTI Systems 2	5, 6
Tue	Jun	13	Frequency Response 1 & 2	6
Thu	Jun	15	Frequency Response 3, Transient Response	6
Tue	Jun	20	Review	-
Thu	Jun	22	**Midterm**	-
Tue	Jul	4	Holiday	-
Thu	Jul	6	Discrete-Time Fourier Transform 1 & 2, Z-Transform 1 & 2	7,9
Tue	Jul	11	Poles and Zeros 1 & 2	9
Thu	Jul	13	IIR Filters 1 & 2	10
Tue	Jul	18	IIR Filters 3, Inverse Z-Transform 1	10
Thu	Jul	20	Inverse Z-Transform 2, Analysis in Three Domains	10
Tue	Jul	25	Discrete Fourier Series 1 & 2	10
Thu	Jul	27	Discrete Fourier Transform 1 & 2	8
Tue	Aug	1	Fast Fourier Transform 1	8
Thu	Aug	3	Fast Fourier Transform 2 & 2.5	8
Tue	Aug	8	Review	--
Thu	Aug	10	**Final Exam**	--

Attendance Policy, Class Expectations, and Make-Up Policy

Attendance & Participation:
This class is taught in the flipped classroom format:
1. Lecture videos, readings, and tutorials will be posted on Canvas before classes. It is MANDATORY that you watch them before the designated class period (see table above). You WILL be quizzed and tested on this material.

2. In class periods, you are expected to work on classwork and MATLAB lab exercises as well as to participate in other in-class activities. The instructor and TAs will be available to help you individually or in small groups with the classwork and lab exercises. Attendance is MANDATORY and may be graded.

Slack Page:
We have a Slack page for the course. This is an *optional* resource for students to discuss the course amongst each other and occasionally with the instructor and TAs. This resource is intended to supplement office hours and student interactions. It also serves as an additional communication medium in class. **No official communications / submissions happen over Slack. No assignment submissions will be accepted over Slack.**

Rough Class Logistics (Tuesday):
- **Part 1:** Discussion / Conversation (15 minutes)
  - This is <u>not</u> a lecture, but a brief discussion or Q&A session to improve your understanding of the material. Therefore, you should come into this with having watched the lecture videos.
- **Part 2:** Big Quiz on previous week material (20 minutes)
- **Part 3:** Class-collaborative coursework (25 minutes)
  - Classwork problems completed as a class
- **Part 4:** Team-collaborative question (45 minutes)
  - Challenging classwork problems completed in teams
- **Part 5:** Design time! Programming and lab discussion (60 minutes)
  - Solve MATLAB problems in the lab

Rough Class Logistics (Thursday):
- **Part 1:** Discussion / Conversation (15 minutes)
  - This is <u>not</u> a lecture, but a brief discussion or Q&A session to improve your understanding of the material. Therefore, you should come into this with having watched the lecture videos.
- **Part 2:** Class-collaborative coursework (30 minutes)
  - Classwork problems completed as a class
- **Part 3:** Team-collaborative coursework (60 minutes)
  - Challenging classwork problems completed in teams
- **Part 4:** Design time! Programming and lab discussion (60 minutes)
  - Solve MATLAB problems in the lab

Requirements for class attendance and make-up exams, assignments, and other work in this course are consistent with university policies. Click here to read the university attendance policies: https://catalog.ufl.edu/UGRD/academic-regulations/attendance-policies/

Evaluation of Grades
The following section discusses the policies for each of the graded assessments in this course. You should look here first for answers to any general, course-related inquiries. **TIP**: Pay attention to the workflow: There will be one weekly big quiz and one weekly little quiz, except the midterm and final weeks. Classwork will be due right after each class period, and lab reports will generally be due every week. **DO NOT FALL BEHIND**.

Classwork (~20 in total)
When: Assigned every class (see course schedule on website).
What: Analytical problems that can be solved by hand.
Why: Classwork is intended to guide you through material and present you with questions that will require time to think and complete. Classwork exercises are meant to be done with your peers and with the instructor's or TAs' help.
Grading: Classwork is graded on a scale of (0) no completion, (0.5) partial completion, or (1) full completion. **You must attend the class session to receive any point on classwork for each class.**
Late policy: Late assignments will not be eligible for any points.
Submission: Classwork will be submitted on canvas within 15 mins after each class.

Mid-term Exam & Final Exam (1 midterm and 1 final in total)

When: The midterm is half-way thru the course on **Thursday, June 22, 2023**. The final is at the end of the course on **Thursday, August 10, 2023**.

What: Analytical problems that can be solved by hand. Similar to the classwork and big quizzes, but may require a deeper understanding of the material.

Why: Exams are an opportunity to show what you know about signals and systems.

Grading: Each exam is graded on a 100-point scale.

Make-up Exams: There are no make-up exams, but the final exam may be used in place of the midterm exam.

Little Quizzes (~10 in total)

When: Occur roughly once every week (except for the midterm and final weeks). The quiz will take roughly 5 minutes.

What: The quizzes are low stack questions about lecture videos.

Why: These quizzes are to ensure that you watched the lectures for the current week, and to collect feedback from you.

Grading: The feedback portion of each little quiz is graded based on completion

Submission: Complete directly on Canvas before 11:59pm every Wednesday.

Big Quizzes (~10 in total)

When: Occur roughly once every Tuesday (except for the midterm and final weeks). The quiz will take roughly 20 minutes.

What: Three or four short analytical problems similar to classwork examples.

Why: These quizzes are intended (1) to help you, the TAs, and the instructor assess your current understanding of material and (2) to broaden the course's grading and lower the stakes of each exam.

Grading: Big quizzes are graded on a 25-point scale.

Re-grades: You may submit a regrade request no later than **one week** after the respective quiz grade has been unmuted. No additional regrades will be accepted. **E-mail or speak in class to the TA who graded your quiz to receive a regrade.** You can appeal the regrades decision by going to the instructor, but only after you have spoken to the TA.

Make-up Policy: If you need to make-up a quiz due to university events, family, or anything major, you must provide documentation to a **course instructor one week** before the due date unless it is something unpredictable, such as medical emergency. If approved, the instructor will forward you to a TA for scheduling. You will have **one week** after the quiz to make it up. Failure to provide proof or not asking for a make-up quiz on time will require the quiz to be taken at the scheduled time.

Labs (~9 in total)

When: There are 9-10 labs over the course of the semester.

What: Each lab consists of MATLAB design exercises. You are expected to complete all exercises in each lab.

Why: In each lab, we apply signals and systems theory to a particular application. This gives you a better understanding about how signals and systems theory is applied in practice using MATLAB.

Reports: After each lab, you are required to submit short reports via Canvas. These reports demonstrate your understanding of the material and should be self-sufficient (i.e., the report should be self-explanatory). **Reports are due 11:59pm every Monday (except for the midterm and final weeks).** In each report, you will be asked to submit your MATLAB code. **Always submit your complete code for each lab assignment, even if it's just one line.** Penalties will be marked off accordingly. **Commenting on code is very important for other classes and in the workforce.** You will receive a penalty for not commenting your code. **Reports will be submitted as PDFs**, using the "publish" function in MATLAB. This will display all of your code and all of your outputs together. If you write a 40-line script, then change one line as an objective later, show both full scripts in your submission. **More info will be provided in the manual of the first lab.**

Late policy: Your late assignments have at maximum of **3 days** before receiving a 0. Every day late receives a 20% late penalty on the maximum possible value. For example, if the assignment is out of 100 points and is due 11:59pm Jan 7, turning it in at 12:00am Jan 8 will result in a maximum of 80 points on the assignment.

Extension Policy: If you need an extension on an assignment due to university events, family, or anything major, you must provide documentation to the TA grading your lab **one week** before the due date unless it is something unpredictable, such as medical emergency. Failure to provide proof or not asking for an extension on time will require the assignment to be submitted on-time.

Re-grades: You may submit a regrade request no later than **one week** after the respective lab grade has been unmuted. No additional regrades will be accepted. **The re-grade be new PDF with comments that start with the word "RE-GRADE."** These comments should state what you want points and why. Submit the new document in the same manner you submitted the assignment. DO NOT EMAIL OR MESSAGE asking for a regrade. If you still don't like the regrade from a TA, you can go to the instructor and ask for an appeal to the regrade, but please go through your lab TA first.

Evaluation of Grades

Assignment	Percentage of Final Grade
Classwork	10%
Graded Labs	25%
Midterm Exam	20%
Final Exam	20%
Little Quizzes	5%
Big Quizzes	20%
	100%

Grading: If the final exam score is greater than the midterm score, then the midterm will be dropped and the final will count for 40% of the grade.

Grading Policy
Note that the table is given as a guideline from the university. The grade thresholds may be adjusted according to the class average.

Percent	Grade	Grade Points
93.4 - 100	A	4.00
90.0 - 93.3	A-	3.67
86.7 - 89.9	B+	3.33
83.4 - 86.6	B	3.00
80.0 - 83.3	B-	2.67
76.7 - 79.9	C+	2.33
73.4 - 76.6	C	2.00
70.0 - 73.3	C-	1.67
66.7 - 69.9	D+	1.33
63.4 - 66.6	D	1.00
60.0 - 63.3	D-	0.67
0 - 59.9	E	0.00

More information on UF grading policy may be found at:
https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx

Students Requiring Accommodations
Students with disabilities who experience learning barriers and would like to request academic accommodations should connect with the disability Resource Center by visiting https://disability.ufl.edu/students/get-started/. It is important for students to share their accommodation letter with their instructor and discuss their access needs, as early as possible in the semester.

Course Evaluation
Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at https://gatorevals.aa.ufl.edu/students/. Students will be notified when the

evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via https://ufl.bluera.com/ufl/. Summaries of course evaluation results are available to students at https://gatorevals.aa.ufl.edu/public-results/.

In-Class Recording
Students are allowed to record video or audio of class lectures. However, the purposes for which these recordings may be used are strictly controlled. The only allowable purposes are (1) for personal educational use, (2) in connection with a complaint to the university, or (3) as evidence in, or in preparation for, a criminal or civil proceeding. All other purposes are prohibited. Specifically, students may not publish recorded lectures without the written consent of the instructor.

A "class lecture" is an educational presentation intended to inform or teach enrolled students about a particular subject, including any instructor-led discussions that form part of the presentation, and delivered by any instructor hired or appointed by the University, or by a guest instructor, as part of a University of Florida course. A class lecture does not include lab sessions, student presentations, clinical presentations such as patient history, academic exercises involving solely student participation, assessments (quizzes, tests, exams), field trips, private conversations between students in the class or between a student and the faculty or lecturer during a class session.

Publication without permission of the instructor is prohibited. To "publish" means to share, transmit, circulate, distribute, or provide access to a recording, regardless of format or medium, to another person (or persons), including but not limited to another student within the same class section. Additionally, a recording, or transcript of a recording, is considered published if it is posted on or uploaded to, in whole or in part, any media platform, including but not limited to social media, book, magazine, newspaper, leaflet, or third party note/tutoring services. A student who publishes a recording without written consent may be subject to a civil cause of action instituted by a person injured by the publication and/or discipline under UF Regulation 4.040 Student Honor Code and Student Conduct Code.

University Honesty Policy
UF students are bound by The Honor Pledge which states, "We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: "On my honor, I have neither given nor received unauthorized aid in doing this assignment." The Conduct Code (https://sccr.dso.ufl.edu/process/student-conduct-code/) specifies a number of behaviors that are in violation of this code and the possible sanctions. If you have any questions or concerns, please consult with the instructor or TAs in this class.

Commitment to a Safe and Inclusive Learning Environment
The Herbert Wertheim College of Engineering values broad diversity within our community and is committed to individual and group empowerment, inclusion, and the elimination of discrimination. It is expected that every person in this class will treat one another with dignity and respect regardless of gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture.

If you feel like your performance in class is being impacted by discrimination or harassment of any kind, please contact your instructor or any of the following:
• Your academic advisor or Graduate Program Coordinator
• Jennifer Nappo, Director of Human Resources, 352-392-0904, jpennacc@ufl.edu
• Curtis Taylor, Associate Dean of Student Affairs, 352-392-2177, taylor@eng.ufl.edu
• Toshikazu Nishida, Associate Dean of Academic Affairs, 352-392-0943, nishida@eng.ufl.edu

Software Use
All faculty, staff, and students of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as

appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

Student Privacy
There are federal laws protecting your privacy with regards to grades earned in courses and on individual assignments. For more information, please see: https://registrar.ufl.edu/ferpa.html

Campus Resources:

<u>*Health and Wellness*</u>

Covid-19 Protocols:
• You are expected to wear approved face coverings at all times during class and within buildings even if you are vaccinated.
• If you are sick, stay home and self-quarantine. Please visit the UF Health Screen, Test & Protect website about next steps, retake the questionnaire and schedule your test for no sooner than 24 hours after your symptoms began. Please call your primary care provider if you are ill and need immediate care or the UF Student Health Care Center at 352-392-1161 (or email covid@shcc.ufl.edu) to be evaluated for testing and to receive further instructions about returning to campus.
• If you are withheld from campus by the Department of Health through Screen, Test & Protect, you are not permitted to use any on campus facilities. Students attempting to attend campus activities when withheld from campus will be referred to the Dean of Students Office.
• UF Health Screen, Test & Protect offers guidance when you are sick, have been exposed to someone who has tested positive or have tested positive yourself. Visit the UF Health Screen, Test & Protect website for more information.
• Please continue to follow healthy habits, including best practices like frequent hand washing. Following these practices is our responsibility as Gators.

U Matter, We Care:
Your well-being is important to the University of Florida. The U Matter, We Care initiative is committed to creating a culture of care on our campus by encouraging members of our community to look out for one another and to reach out for help if a member of our community is in need. If you or a friend is in distress, please contact umatter@ufl.edu so that the U Matter, We Care Team can reach out to the student in distress. A nighttime and weekend crisis counselor is available by phone at 352-392-1575. The U Matter, We Care Team can help connect students to the many other helping resources available including, but not limited to, Victim Advocates, Housing staff, and the Counseling and Wellness Center. Please remember that asking for help is a sign of strength. In case of emergency, call 9-1-1.

Counseling and Wellness Center: https://counseling.ufl.edu, and 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

Sexual Discrimination, Harassment, Assault, or Violence
If you or a friend has been subjected to sexual discrimination, sexual harassment, sexual assault, or violence contact the **Office of Title IX Compliance**, located at Yon Hall Room 427, 1908 Stadium Road, (352) 273-1094, title-ix@ufl.edu

Sexual Assault Recovery Services (SARS)
Student Health Care Center, 392-1161.

University Police Department at 392-1111 (or 9-1-1 for emergencies), or http://www.police.ufl.edu/.

<u>*Academic Resources*</u>

E-learning technical suppor*t*, 352-392-4357 (select option 2) or e-mail to Learning-support@ufl.edu. https://lss.at.ufl.edu/help.shtml.

Career Connections Center, Reitz Union, 392-1601. Career assistance and counseling; https://career.ufl.edu.

Library Support, http://cms.uflib.ufl.edu/ask. Various ways to receive assistance with respect to using the libraries or finding resources.

Teaching Center, Broward Hall, 392-2010 or 392-6420. General study skills and tutoring. https://teachingcenter.ufl.edu/.

Writing Studio, 302 Tigert Hall, 846-1138. Help brainstorming, formatting, and writing papers. https://writing.ufl.edu/writing-studio/.

Student Complaints Campus*: https://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-code/;https://care.dso.ufl.edu.

On-Line Students Complaints*: http://www.distance.ufl.edu/student-complaint-process.